FCC TEST REPORT (15.407)

REPORT NO.:	RF120719C20C-1
MODEL NO.:	NWA1123-NI, NWA5123-NI
FCC ID:	I88NWA1123-NI
RECEIVED:	Apr. 09, 2014
TESTED:	Apr. 09 ~ May 21, 2014
ISSUED:	May 23, 2014

APPLICANT:	ZyXEL Communications Corporation
ADDRESS:	No. 2, Gongye E. 9th Road Hsinchu Science Park, Hsinchu, Taiwan

ISSUED BY:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
LAB ADDRESS:	No. 47, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan, R.O.C.
TEST LOCATION:	No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

This report should not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF120719C20C-1	Original release	May 23, 2014

1. CERTIFICATION

PRODUCT: 802.11 a/b/g/n Dual-Radio PoE Access Point
MODEL: NWA1123-NI, NWA5123-NI
BRAND: ZyXEL
APPLICANT: ZyXEL Communications Corporation
TESTED: Apr. 09 ~ May 21, 2014
TEST SAMPLE: ENGINEERING SAMPLE
STANDARDS: **FCC Part 15, Subpart E (Section 15.407)**
ANSI C63.10-2009

The above equipment (model: NWA1123-NI) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch,** and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

PREPARED BY : _____ , **DATE :** May 23, 2014
Pettie Chen / Senior Specialist

APPROVED BY : _____ , **DATE :** May 23, 2014
Ken Liu / Senior Manager

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART E (SECTION 15.407)			
STANDARD SECTION	**TEST TYPE**	**RESULT**	**REMARK**
15.407(b)(6)	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -6.91dB at 0.32207MHz.
15.407(b/1/2/3)(b)(6)	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -1.0dB at 5150.00MHz.
15.407(a/1/2)	Max Average Transmit Power	PASS	Meet the requirement of limit.
15.407(a)(6)	Peak Power Excursion	PASS	Meet the requirement of limit.
15.407(a/1/2)	Peak Power Spectral Density	PASS	Meet the requirement of limit.
15.407(g)	Frequency Stability	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is IPEX 1 not a standard connector.

2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	3.19 dB
	200MHz ~1000MHz	3.21 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

EUT	802.11 a/b/g/n Dual-Radio PoE Access Point
MODEL NO.	NWA1123-NI, NWA5123-NI
POWER SUPPLY	12Vdc (Adapter) 55Vdc (PoE)
MODULATION TYPE	64QAM, 16QAM, QPSK, BPSK
MODULATION TECHNOLOGY	OFDM
TRANSFER RATE	802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 300.0Mbps
OPERATING FREQUENCY	5180.0 ~ 5240.0MHz
NUMBER OF CHANNEL	4 for 802.11a, 802.11n (20MHz) 2 for 802.11n (40MHz)
OUTPUT POWER	48.597mW
ANTENNA TYPE	Refer to Note
ANTENNA CONNECTOR	Refer to Note
DATA CABLE	N/A
I/O PORTS	Refer to user's manual
ACCESSORY DEVICES	Adapter

NOTE:

1. All models are listed as below.

Brand	Model	Different
ZyXEL	NWA1123-NI	All models are identical to each other except for their model designation due to marketing purpose.
	NWA5123-NI	

2. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

MODULATION MODE	TX FUNCTION
802.11a	2TX
802.11n (20MHz)	2TX
802.11n (40MHz)	2TX

3. The following antennas were provided to the EUT.

Band	Antenna Type	Brand	Model	Gain (dBi)	Connector
5.0GHz Band	PCB	SINBON	A9701670	5.2	IPEX 1
	PCB	SINBON	A9701671	6.1	IPEX 1

4. The EUT uses following adapter & PoE.

Adapter	
Brand	DVE
Model	DSA-12CA-12
Input Power	100-240Vac, 50/60Hz, 0.3A
Output Power	+12Vdc, 1A
Power Line	1.5m non-shielded cable w/o core

POE (Support unit only)	
Brand	PowerDsine
Model	PD9001G
Input Power	100-250Vac,50/60Hz,0.8A
Output Power	55Vdc,0.60A

5. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 DESCRIPTION OF TEST MODES

4 channels are provided for 802.11a, 802.11n (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
36	5180MHz	44	5220MHz
40	5200MHz	48	5240MHz

2 channels are provided for 802.11n (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
38	5190MHz	46	5230MHz

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
A	√	√	√	√	Power from adapter
B	-	√	√	-	Power from PoE

Where **RE≥1G:** Radiated Emission above 1GHz **RE<1G:** Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

NOTE 1:
The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane.**
NOTE 2: "-" means no effect.

RADIATED EMISSION TEST (ABOVE 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A	802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0
A	802.11n (20MHz)	36 to 48	36, 40, 48	OFDM	BPSK	7.2
A	802.11n (40MHz)	38 to 46	38, 46	OFDM	BPSK	15.0

RADIATED EMISSION TEST (BELOW 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A, B	802.11n (40MHz)	38 to 46	46	OFDM	BPSK	15.0

POWER LINE CONDUCTED EMISSION TEST:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A, B	802.11n (40MHz)	38 to 46	46	OFDM	BPSK	15.0

ANTENNA PORT CONDUCTED MEASUREMENT:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A	802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0
A	802.11n (20MHz)	36 to 48	36, 40, 48	OFDM	BPSK	7.2
A	802.11n (40MHz)	38 to 46	38, 46	OFDM	BPSK	15.0

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	24deg. C, 66%RH	120Vac, 60Hz	Ted Chang Sun Lin
RE<1G	25deg. C, 65%RH	120Vac, 60Hz 48Vdc	Ted Chang
PLC	25deg. C, 65%RH 24deg. C, 64%RH	120Vac, 60Hz 48Vdc	Ted Chang Mach Tsui
APCM	25deg. C, 65%RH	120Vac, 60Hz	Mach Tsui

3.3 DUTY CYCLE OF TEST SIGNAL

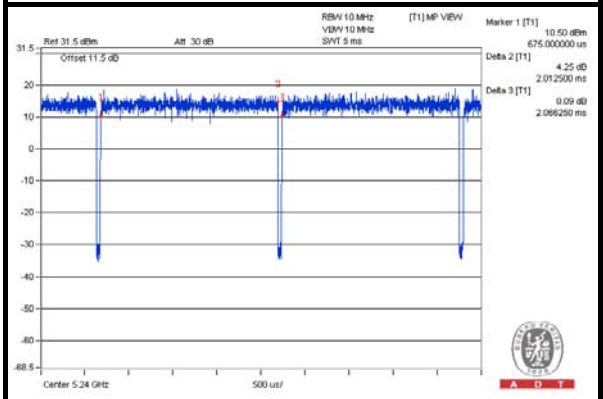
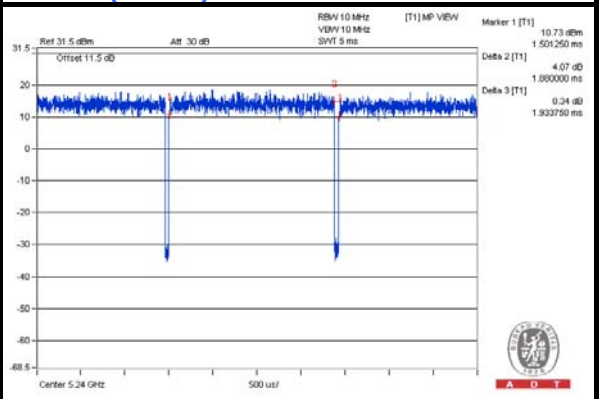
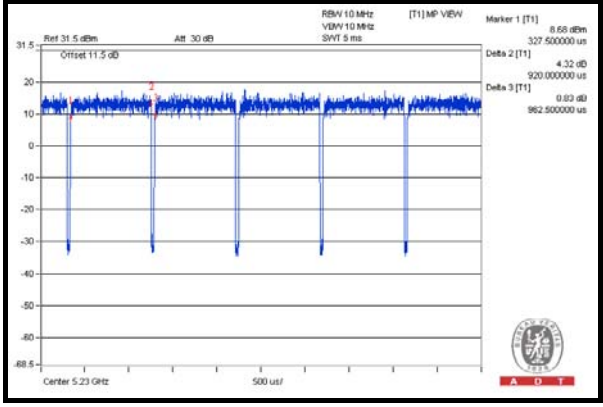
MODULATION TYPE: BPSK

Duty cycle is < 98%, duty factor shall be considered.

802.11a: Duty cycle = 2.013/2.066 = 0.974, Duty factor = 10 * log(1/0.974) = 0.11

802.11n (20MHz): Duty cycle = 1.88/1.934 = 0.972, Duty factor = 10 * log(1/0.972) = 0.12

802.11n (40MHz): Duty cycle = 0.92/0.963 = 0.956, Duty factor = 10 * log(1/0.956) = 0.20

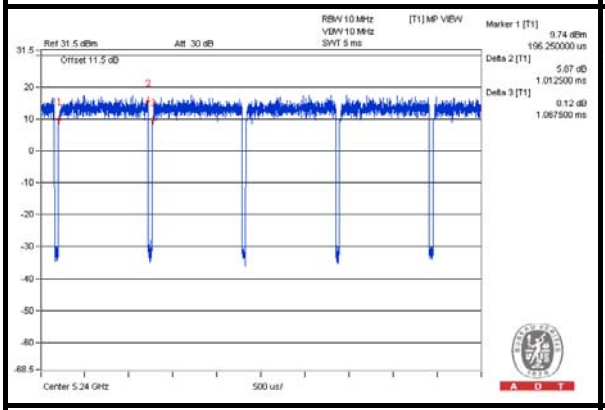
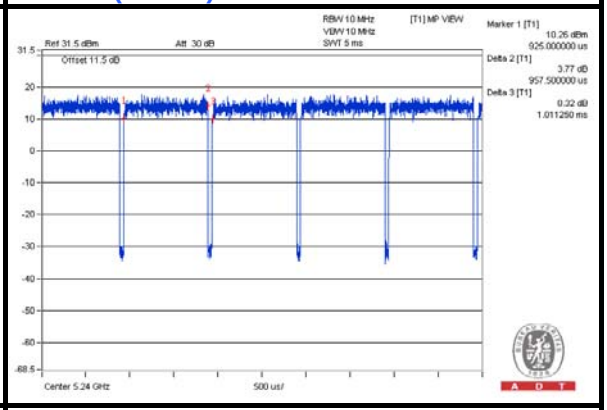
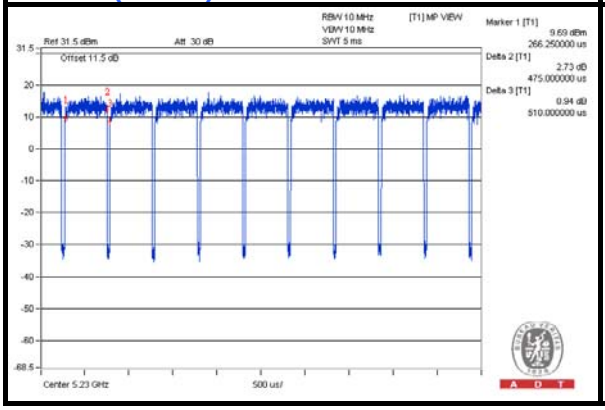
802.11a	802.11n (20MHz)
	
802.11n (40MHz)	
	

MODULATION TYPE: QPSK

802.11a: Duty cycle = 1.013/1.068 = 0.974, Duty factor = 10 * log(1/0.974) = 0.11

802.11n (20MHz): Duty cycle = 0.958/1.011 = 0.947, Duty factor = 10 * log(1/0.947) = 0.24

802.11n (40MHz): Duty cycle = 0.475/0.51 = 0.931, Duty factor = 10 * log(1/0.931) = 0.31

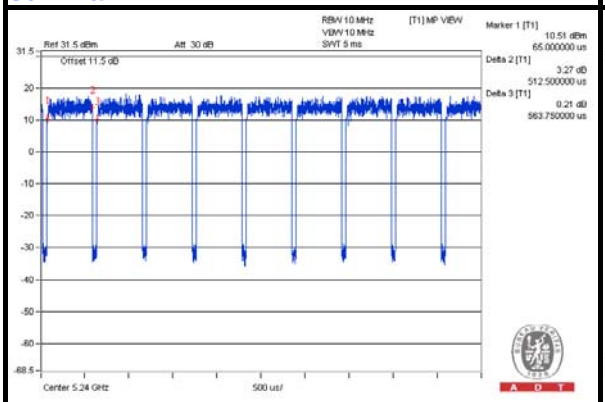
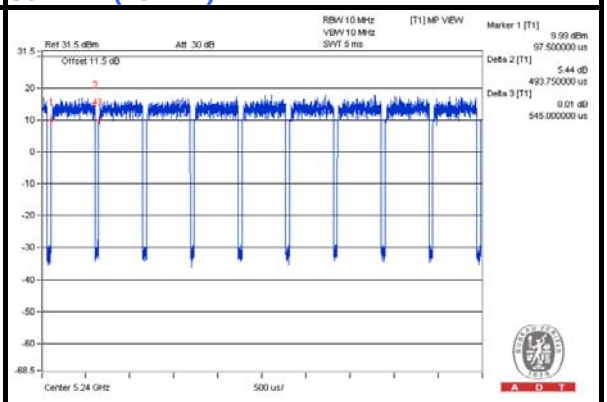
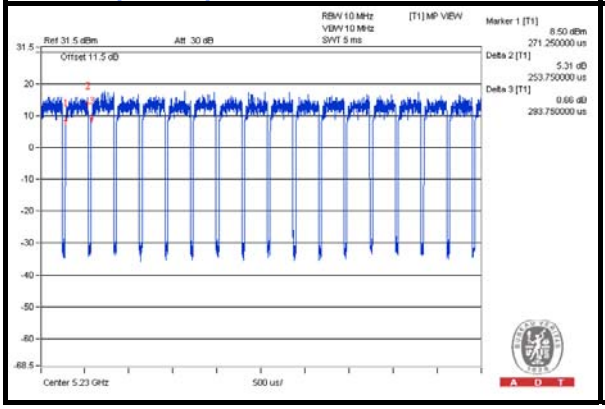
802.11a	802.11n (20MHz)
	
802.11n (40MHz)	
	

MODULATION TYPE: 16QAM

802.11a: Duty cycle = 0.513/0.564 = 0.909, Duty factor = 10 * log(1/0.909) = 0.41

802.11n (20MHz): Duty cycle = 0.494/0.545 = 0.906, Duty factor = 10 * log(1/0.906) = 0.43

802.11n (40MHz): Duty cycle = 0.254/0.294 = 0.864, Duty factor = 10 * log(1/0.864) = 0.64

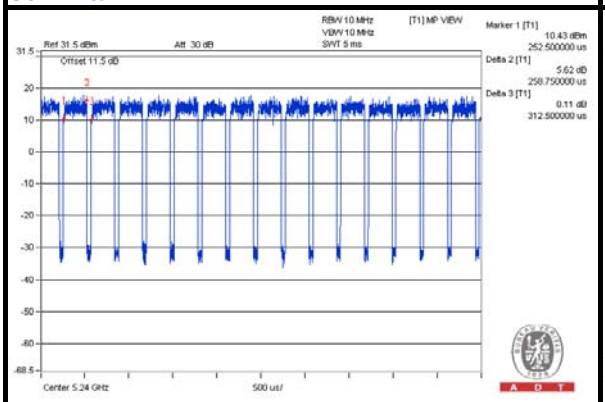
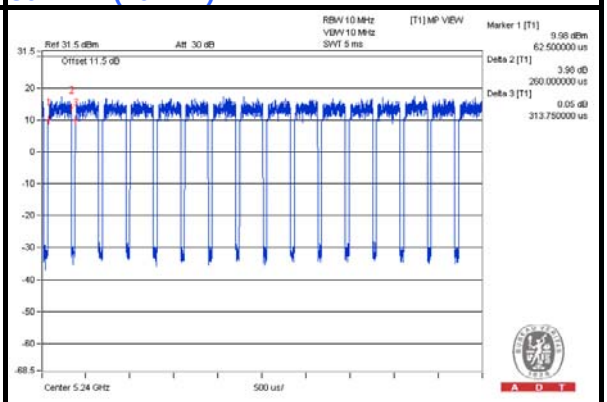
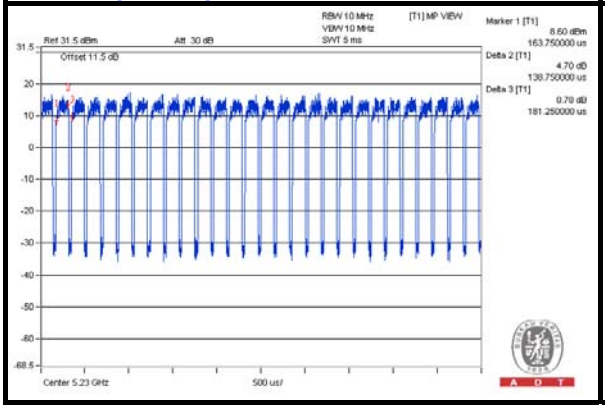
802.11a	802.11n (20MHz)
	
802.11n (40MHz)	
	

MODULATION TYPE: 64QAM

802.11a: Duty cycle = 0.259/0.313 = 0.828, Duty factor = 10 * log(1/0.828) = 0.82

802.11n (20MHz): Duty cycle = 0.26/0.314 = 0.829, Duty factor = 10 * log(1/0.829) = 0.82

802.11n (40MHz): Duty cycle = 0.139/0.181 = 0.766, Duty factor = 10 * log(1/0.766) = 1.16

802.11a	802.11n (20MHz)
	
802.11n (40MHz)	
	

3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

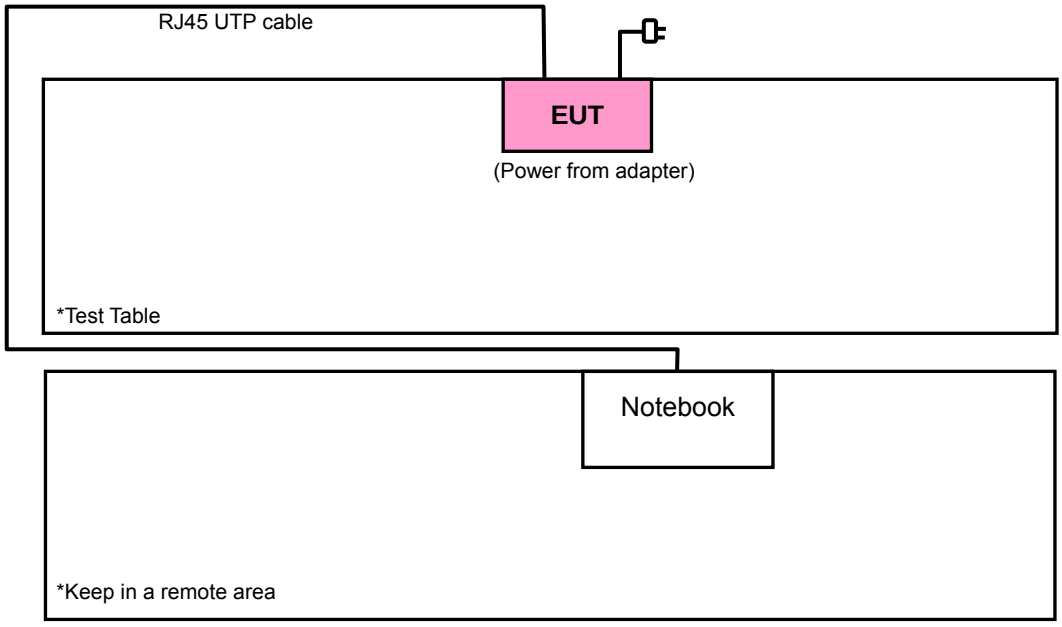
NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Notebook	DELL	E5410	1HC2XM1	FCC DoC Approved
2	POE	PowerDsine	PD9001G	NA	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	10m RJ45 UTP cable
2	10m RJ45 UTP cable

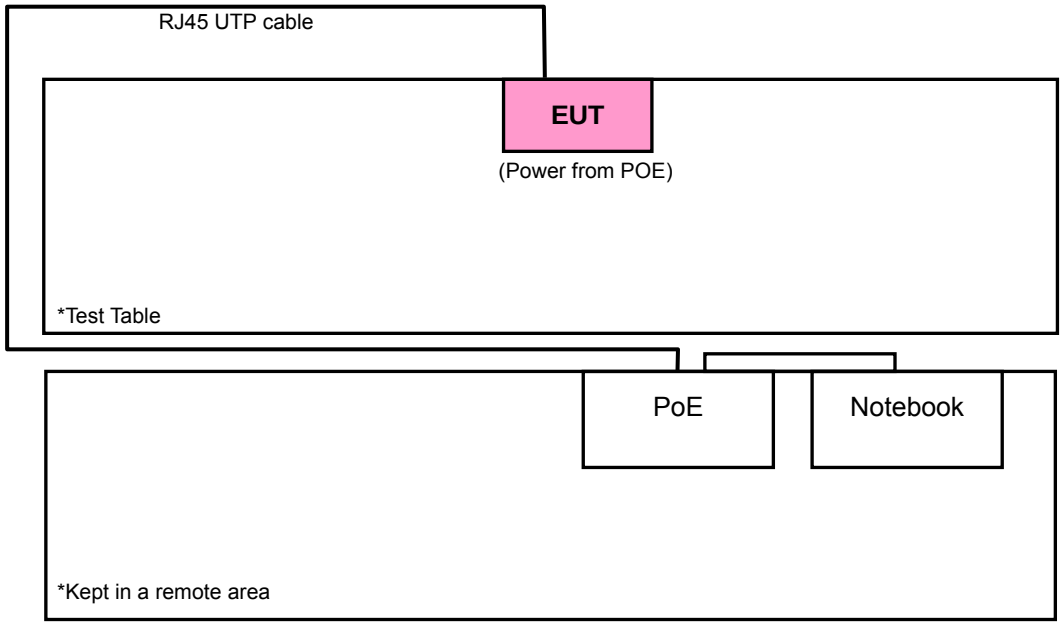
NOTE:
1. All power cords of the above support units are non-shielded (1.8 m).
2. Item 1, 2 acted as a communication partner to transfer data.
3. Item 2 was provided by client.

3.4.1 CONFIGURATION OF SYSTEM UNDER TEST

Test Mode A



Test Mode B



3.5 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart E (15.407)
789033 D01 General UNII Test Procedures v01r03
662911 D01 Multiple Transmitter Output v02
ANSI C63.10-2009

All test items have been performed and recorded as per the above standards.

NOTE: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table:

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 30dB under any condition of modulation.

4.1.2 LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

APPLICABLE TO	LIMIT	
√	FIELD STRENGTH AT 3m (dBμV/m)	
	PK	AV
	74	54
	EIRP LIMIT (dBm)	EQUIVALENT FIELD STRENGTH AT 3m (dBμV/m)
	PK	PK
	-27	68.3

NOTE: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts).

4.1.3 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCS30	100289	Nov. 29, 2013	Nov. 28, 2014
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Feb. 11, 2014	Feb. 10, 2015
BILOG Antenna SCHWARZBECK	VULB9168	9168-156	Feb. 25, 2014	Feb. 24, 2015
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-209	Sep. 12, 2013	Sep. 11, 2014
HORN Antenna SCHWARZBECK	BBHA 9170	148	Jul. 15, 2013	Jul. 14, 2014
Preamplifier Agilent	8449B	3008A01911	Aug. 22, 2013	Aug. 21, 2014
Preamplifier Agilent	8447D	2944A10638	Oct. 18, 2013	Oct. 17, 2014
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	248780/4 309222/4 274092/4	Aug. 26, 2013	Aug. 25, 2014
RF signal cable Worken	5D-FB	Cable-HYCH9-01	Aug. 11, 2013	Aug. 10, 2014
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower &Turn Table Controller EMCO	2090	NA	NA	NA
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 18, 2013	Oct. 17, 2014
High Speed Peak Power Meter	ML2495A	0824011	Jul. 29, 2013	Jul. 28, 2014
Power Sensor	MA2411B	0738171	Jul. 29, 2013	Jul. 28, 2014
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 10, 2013	Jun. 09, 2014

NOTE:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 9.
3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 215374.
5. The IC Site Registration No. is IC 7450F-9.

4.1.4 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

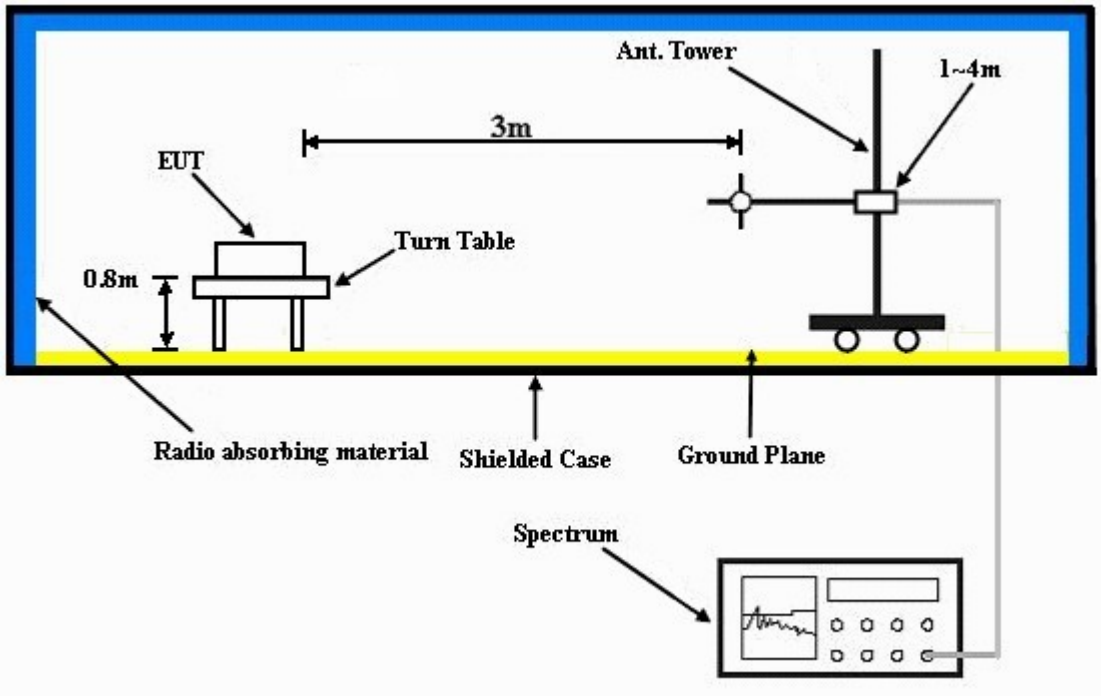
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 1kHz(Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.5 DEVIATION FROM TEST STANDARD

No deviation.

4.1.6 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.7 EUT OPERATING CONDITION

a. Placed the EUT on the testing table.
b. Prepared notebook to act as communication partner and placed it outside of testing area.
c. The communication partner connected with EUT via a RJ45 cable and run a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
d. The communication partner sent data to EUT by command "PING".

4.1.8 TEST RESULTS

ABOVE 1GHz DATA:

802.11a

CHANNEL	TX Channel 36	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	5150.00	60.4 PK	74.0	-13.6	1.00 H	347	58.00	2.40
2	5150.00	45.1 AV	54.0	-8.9	1.00 H	347	42.70	2.40
3	*5180.00	107.2 PK			1.00 H	351	67.80	39.40
4	*5180.00	96.2 AV			1.00 H	351	56.80	39.40
5	10360.00	56.8 PK	74.0	-17.2	1.46 H	312	42.90	13.90
6	10360.00	46.5 AV	54.0	-7.5	1.46 H	312	32.60	13.90
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	5150.00	58.0 PK	74.0	-16.0	1.09 V	38	55.60	2.40
2	5150.00	44.2 AV	54.0	-9.8	1.09 V	38	41.80	2.40
3	*5180.00	107.6 PK			1.09 V	38	68.20	39.40
4	*5180.00	95.8 AV			1.09 V	38	56.40	39.40
5	10360.00	58.1 PK	74.0	-15.9	1.28 V	70	44.20	13.90
6	10360.00	48.1 AV	54.0	-5.9	1.28 V	70	34.20	13.90

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5200.00	109.9 PK			1.00 H	352	70.40	39.50
2	*5200.00	96.7 AV			1.00 H	352	57.20	39.50
3	10400.00	58.1 PK	74.0	-15.9	1.48 H	322	44.00	14.10
4	10400.00	48.2 AV	54.0	-5.8	1.48 H	322	34.10	14.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5200.00	110.4 PK			1.05 V	41	70.90	39.50
2	*5200.00	97.2 AV			1.05 V	41	57.70	39.50
3	10400.00	58.9 PK	74.0	-15.1	1.21 V	52	44.80	14.10
4	10400.00	48.9 AV	54.0	-5.1	1.21 V	52	34.80	14.10

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 48	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	106.7 PK			1.04 H	322	67.10	39.60
2	*5240.00	94.8 AV			1.04 H	322	55.20	39.60
3	5350.00	58.4 PK	74.0	-15.6	1.04 H	322	55.80	2.60
4	5350.00	44.8 AV	54.0	-9.2	1.04 H	322	42.20	2.60
5	10480.00	57.9 PK	74.0	-16.1	1.51 H	304	42.60	15.30
6	10480.00	47.5 AV	54.0	-6.5	1.51 H	304	32.20	15.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	107.1 PK			1.00 V	80	67.50	39.60
2	*5240.00	95.5 AV			1.00 V	80	55.90	39.60
3	5350.00	59.0 PK	74.0	-15.0	1.00 V	82	56.40	2.60
4	5350.00	45.5 AV	54.0	-8.5	1.00 V	82	42.90	2.60
5	10480.00	60.1 PK	74.0	-13.9	1.22 V	46	44.80	15.30
6	10480.00	49.9 AV	54.0	-4.1	1.22 V	46	34.60	15.30

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11n (20MHz)

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	60.9 PK	74.0	-13.1	1.00 H	352	58.50	2.40
2	5150.00	43.9 AV	54.0	-10.1	1.00 H	352	41.50	2.40
3	*5180.00	108.2 PK			1.00 H	356	68.80	39.40
4	*5180.00	98.2 AV			1.00 H	356	58.80	39.40
5	10360.00	58.5 PK	74.0	-15.5	1.52 H	304	44.60	13.90
6	10360.00	48.1 AV	54.0	-5.9	1.52 H	304	34.20	13.90
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	57.8 PK	74.0	-16.2	1.07 V	25	55.40	2.40
2	5150.00	45.1 AV	54.0	-8.9	1.07 V	25	42.70	2.40
3	*5180.00	108.8 PK			1.05 V	22	69.40	39.40
4	*5180.00	97.9 AV			1.05 V	22	58.50	39.40
5	10360.00	59.0 PK	74.0	-15.0	1.45 V	52	45.10	13.90
6	10360.00	49.1 AV	54.0	-4.9	1.45 V	52	35.20	13.90

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5200.00	108.2 PK			1.12 H	354	68.70	39.50
2	*5200.00	98.4 AV			1.12 H	354	58.90	39.50
3	10400.00	56.8 PK	74.0	-17.2	1.42 H	298	42.70	14.10
4	10400.00	46.9 AV	54.0	-7.1	1.42 H	298	32.80	14.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5200.00	109.4 PK			1.06 V	28	69.90	39.50
2	*5200.00	98.2 AV			1.06 V	28	58.70	39.50
3	10400.00	58.9 PK	74.0	-15.1	1.52 V	78	44.80	14.10
4	10400.00	49.8 AV	54.0	-4.2	1.52 V	78	35.70	14.10

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 48	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	108.8 PK			1.02 H	358	69.20	39.60
2	*5240.00	98.5 AV			1.02 H	358	58.90	39.60
3	5350.00	54.3 PK	74.0	-19.7	1.02 H	358	51.70	2.60
4	5350.00	44.2 AV	54.0	-9.8	1.02 H	358	41.60	2.60
5	10480.00	59.4 PK	74.0	-14.6	1.49 H	298	44.10	15.30
6	10480.00	49.8 AV	54.0	-4.2	1.49 H	298	34.50	15.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	109.7 PK			1.06 V	24	70.10	39.60
2	*5240.00	98.7 AV			1.06 V	24	59.10	39.60
3	5350.00	58.4 PK	74.0	-15.6	1.06 V	24	55.80	2.60
4	5350.00	45.5 AV	54.0	-8.5	1.06 V	24	42.90	2.60
5	10480.00	60.1 PK	74.0	-13.9	1.28 V	64	44.80	15.30
6	10480.00	49.5 AV	54.0	-4.5	1.28 V	64	34.20	15.30

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11n (40MHz)

CHANNEL	TX Channel 38	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	69.1 PK	74.0	-4.9	1.12 H	358	66.70	2.40
2	**5150.00**	**53.0 AV**	**54.0**	**-1.0**	**1.12 H**	**358**	**50.60**	**2.40**
3	*5190.00	102.7 PK			1.14 H	357	63.20	39.50
4	*5190.00	93.2 AV			1.14 H	357	53.70	39.50
5	10380.00	58.8 PK	74.0	-15.2	1.46 H	296	44.70	14.10
6	10380.00	47.8 AV	54.0	-6.2	1.46 H	296	33.70	14.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	68.6 PK	74.0	-5.4	1.06 V	12	66.20	2.40
2	5150.00	52.8 AV	54.0	-1.2	1.06 V	12	50.40	2.40
3	*5190.00	104.1 PK			1.04 V	24	64.60	39.50
4	*5190.00	95.4 AV			1.04 V	24	55.90	39.50
5	10380.00	59.3 PK	74.0	-14.7	1.57 V	62	45.20	14.10
6	10380.00	48.9 AV	54.0	-5.1	1.57 V	62	34.80	14.10

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 46	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5230.00	108.2 PK			1.00 H	17	68.60	39.60
2	*5230.00	98.5 AV			1.00 H	17	58.90	39.60
3	5350.00	57.1 PK	74.0	-16.9	1.04 H	17	54.50	2.60
4	5350.00	47.5 AV	54.0	-6.5	1.04 H	17	44.90	2.60
5	10460.00	57.6 PK	74.0	-16.4	1.35 H	317	42.80	14.80
6	10460.00	47.2 AV	54.0	-6.8	1.35 H	317	32.40	14.80
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5230.00	108.8 PK			1.04 V	20	69.20	39.60
2	*5230.00	98.8 AV			1.04 V	20	59.20	39.60
3	5350.00	59.5 PK	74.0	-14.5	1.04 V	24	56.90	2.60
4	5350.00	47.4 AV	54.0	-6.6	1.04 V	24	44.80	2.60
5	10460.00	57.4 PK	74.0	-16.6	1.48 V	360	42.60	14.80
6	10460.00	47.2 AV	54.0	-6.8	1.48 V	360	32.40	14.80

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

BELOW 1GHz WORST-CASE DATA

802.11n (40MHz)

CHANNEL	TX Channel 46	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		
TEST MODE	A		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	124.82	33.8 PK	43.5	-9.7	1.24 H	154	49.70	-15.90
2	249.18	39.1 PK	46.0	-6.9	1.49 H	225	53.30	-14.20
3	399.97	42.2 PK	46.0	-3.8	1.99 H	144	52.40	-10.20
4	499.46	43.1 PK	46.0	-2.9	1.49 H	224	51.50	-8.40
5	600.50	43.3 PK	46.0	-2.7	1.00 H	167	49.50	-6.20
6	1000.00	45.6 PK	54.0	-8.4	1.24 H	145	45.10	0.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	124.82	35.6 PK	43.5	-7.9	1.24 V	241	51.50	-15.90
2	375.10	39.9 PK	46.0	-6.1	1.24 V	115	50.50	-10.60
3	499.46	40.4 PK	46.0	-5.6	1.49 V	258	48.80	-8.40
4	600.50	43.3 PK	46.0	-2.7	1.99 V	238	49.50	-6.20
5	875.64	39.7 PK	46.0	-6.3	1.24 V	205	41.30	-1.60
6	1000.00	42.2 PK	54.0	-11.8	1.00 V	225	41.70	0.50

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

802.11n (40MHz)

CHANNEL	TX Channel 46	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		
TEST MODE	B		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	249.18	39.6 QP	46.0	-6.4	1.00 H	276	53.80	-14.20
2	375.10	41.8 QP	46.0	-4.2	1.00 H	241	52.40	-10.60
3	599.99	44.0 QP	46.0	-2.0	1.09 H	214	50.20	-6.20
4	625.37	42.5 QP	46.0	-3.5	1.00 H	317	48.10	-5.60
5	749.73	40.2 QP	46.0	-5.8	1.00 H	149	44.00	-3.80
6	1000.00	46.8 QP	54.0	-7.2	1.26 H	172	46.30	0.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	47.60	38.9 QP	40.0	-1.1	1.24 V	16	53.00	-14.10
2	124.82	33.4 QP	43.5	-10.1	1.00 V	16	49.30	-15.90
3	249.18	38.0 QP	46.0	-8.0	1.00 V	4	52.20	-14.20
4	375.10	38.6 QP	46.0	-7.4	1.24 V	174	49.20	-10.60
5	499.46	37.6 QP	46.0	-8.4	1.00 V	198	46.00	-8.40
6	625.37	37.6 QP	46.0	-8.4	1.49 V	178	43.20	-5.60

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.2 CONDUCTED EMISSION MEASUREMENT

4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

NOTE: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCS30	100288	Apr. 24, 2014	Apr. 23, 2015
RF signal cable Woken	5D-FB	Cable-HYCO2-01	Dec. 27, 2013	Dec. 26, 2014
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Dec. 23, 2013	Dec. 22, 2014
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 08, 2013	Jul. 07, 2014
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Shielded Room 2.

3. The VCCI Site Registration No. is C-2047.

4.2.3 TEST PROCEDURES

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

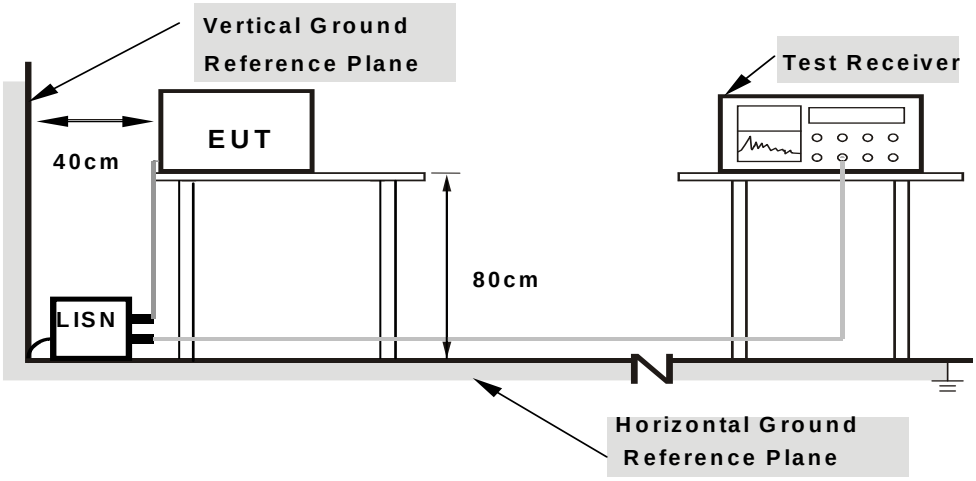
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

4.2.5 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT OPERATING CONDITIONS

Same as 4.1.6.

4.2.7 TEST RESULTS

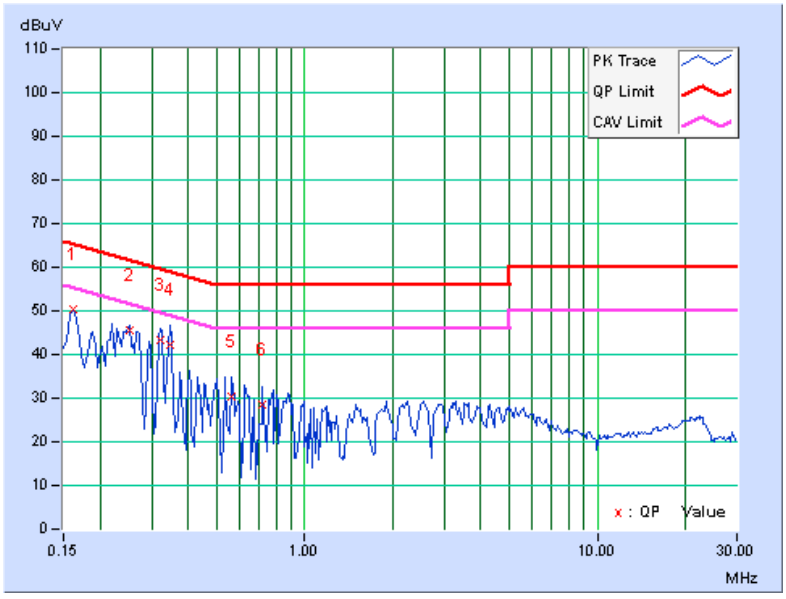
CONDUCTED WORST-CASE DATA：802.11n (40MHz)

PHASE	Line 1	6dB BANDWIDTH	9kHz
TEST MODE	A		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16201	0.22	50.04	40.91	50.26	41.13	65.36	55.36	-15.10	-14.23
2	0.25156	0.23	45.22	38.91	45.45	39.14	61.71	51.71	-16.25	-12.56
3	0.32187	0.23	42.92	34.62	43.15	34.85	59.66	49.66	-16.51	-14.81
4	0.34557	0.23	42.06	41.74	42.29	41.97	59.07	49.07	-16.78	-7.10
5	0.56406	0.24	30.12	24.82	30.36	25.06	56.00	46.00	-25.64	-20.94
6	0.72031	0.26	28.24	24.68	28.50	24.94	56.00	46.00	-27.50	-21.06

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

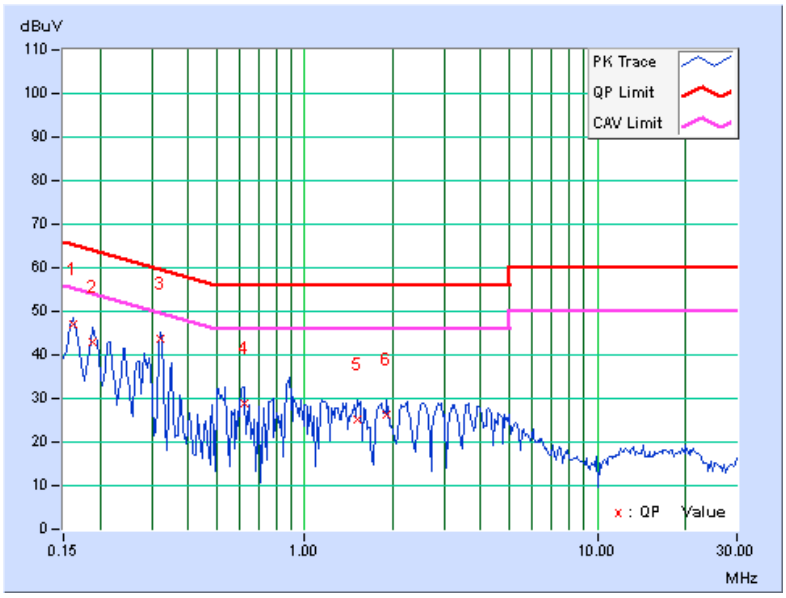


PHASE	Line 2	6dB BANDWIDTH	9kHz
TEST MODE	A		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16142	0.23	46.68	37.75	46.91	37.98	65.39	55.39	-18.48	-17.41
2	0.18906	0.24	42.62	34.64	42.86	34.88	64.08	54.08	-21.22	-19.20
3	**0.32207**	**0.28**	**43.28**	**42.47**	**43.56**	**42.75**	**59.65**	**49.65**	**-16.10**	**-6.91**
4	0.61875	0.30	28.45	21.47	28.75	21.77	56.00	46.00	-27.25	-24.23
5	1.50782	0.34	24.69	22.41	25.03	22.75	56.00	46.00	-30.97	-23.25
6	1.91016	0.38	25.82	20.46	26.20	20.84	56.00	46.00	-29.80	-25.16

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

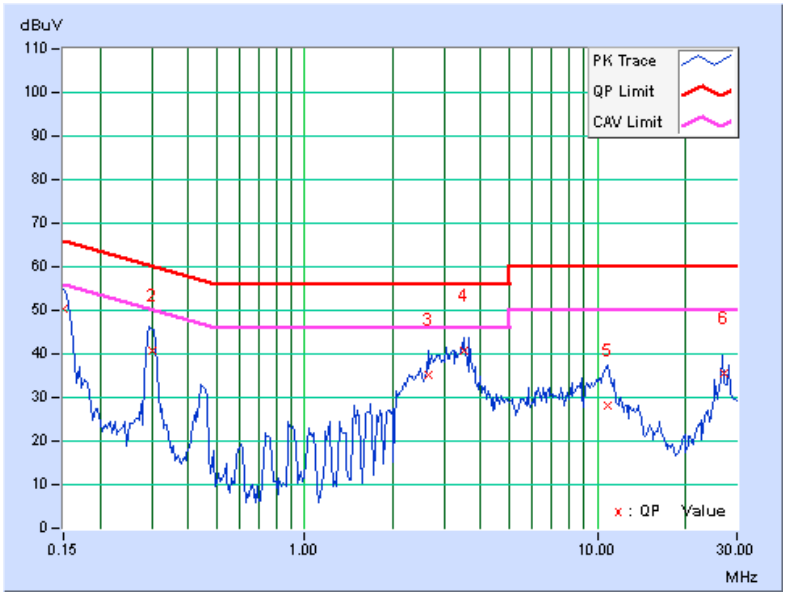


PHASE	Line 1	6dB BANDWIDTH	9kHz
TEST MODE	B		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15001	0.22	50.22	35.47	50.44	35.69	66.00	56.00	-15.56	-20.31
2	0.29982	0.23	40.41	27.62	40.64	27.85	60.25	50.25	-19.61	-22.40
3	2.64848	0.39	34.84	30.59	35.23	30.98	56.00	46.00	-20.77	-15.02
4	3.49214	0.42	40.47	31.62	40.89	32.04	56.00	46.00	-15.11	-13.96
5	10.86269	0.52	27.45	21.02	27.97	21.54	60.00	50.00	-32.03	-28.46
6	26.95752	0.60	34.95	30.47	35.55	31.07	60.00	50.00	-24.45	-18.93

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

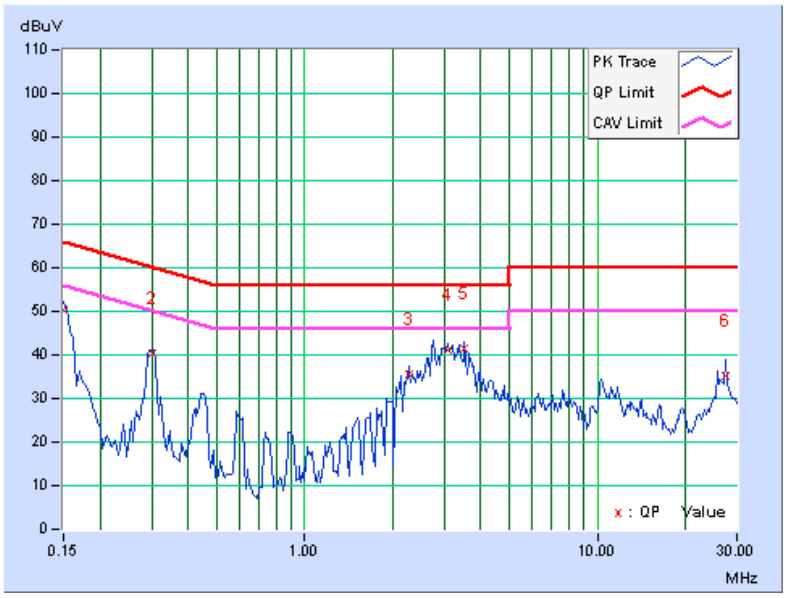


PHASE	Line 2	6dB BANDWIDTH	9kHz
TEST MODE	B		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15001	0.23	50.15	44.95	50.38	45.18	66.00	56.00	-15.62	-10.82
2	0.30238	0.27	40.26	34.92	40.53	35.19	60.18	50.18	-19.65	-14.99
3	2.26558	0.40	35.15	30.09	35.55	30.49	56.00	46.00	-20.45	-15.51
4	3.07424	0.44	40.62	30.08	41.06	30.52	56.00	46.00	-14.94	-15.48
5	3.51582	0.47	40.92	34.72	41.39	35.19	56.00	46.00	-14.61	-10.81
6	27.34958	0.69	34.62	29.47	35.31	30.16	60.00	50.00	-24.69	-19.84

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



4.3 PEAK TRANSMIT POWER MEASUREMENT

4.3.1 LIMITS OF PEAK TRANSMIT POWER MEASUREMENT

FREQUENCY BAND	LIMIT
5.15 ~ 5.25GHz	The lesser of 50mW (17dBm) or 4dBm + 10logB

NOTE: Where B is the 26dB emission bandwidth in MHz.

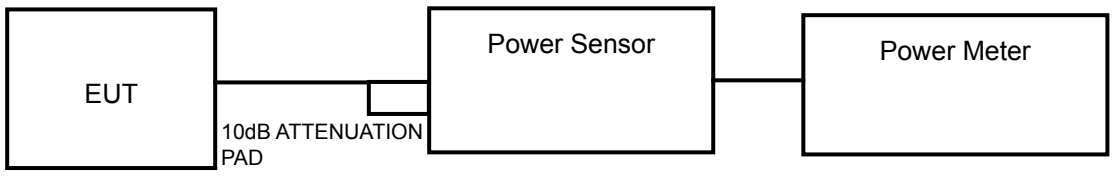
Per KDB 662911 D01 Multiple Transmitter Output v02 Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any NANT;
Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less for 20-MHz channel widths with NANT ≥ 5.

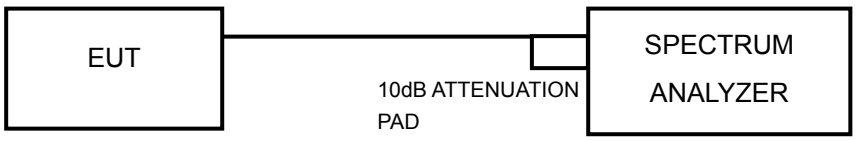
For power measurements on all other devices: Array Gain = 10 log(NANT/NSS) dB.

4.3.2 TEST SETUP

FOR POWER OUTPUT MEASUREMENT



FOR 26dB BANDWIDTH



4.3.3 TEST INSTRUMENTS

Refer to section 4.1.3 to get information of above instrument.

4.3.4 TEST PROCEDURE

FOR AVERAGE POWER MEASUREMENT

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

FOR 26dB BANDWIDTH

1) Set RBW = approximately 1% of the emission bandwidth.
2) Set the VBW > RBW.
3) Detector = Peak.
4) Trace mode = max hold.
5) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

4.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

4.3.7 TEST RESULTS

POWER OUTPUT: 802.11a

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
36	5180	10.96	10.13	22.778	13.58	16.90	PASS
40	5200	11.10	10.48	24.051	13.81	16.90	PASS
48	5240	10.95	10.33	23.234	13.66	16.90	PASS

***** Gain = 6.1dBi > 6dBi, so the conducted power limit shall be reduced to 17-(6.1-6) = 16.90dBm.

NOTE:

CHAIN 0:

1. 4dBm + 10log(23.55) = 17.72 dBm > 16.90dBm
2. 4dBm + 10log(24.63) = 17.91 dBm > 16.90dBm
3. 4dBm + 10log(24.40) = 17.87 dBm > 16.90dBm

CHAIN 1:

1. 4dBm + 10log(23.87) = 17.78 dBm > 16.90dBm
2. 4dBm + 10log(23.14) = 17.64 dBm > 16.90dBm
3. 4dBm + 10log(23.67) = 17.74 dBm > 16.90dBm

802.11n (20MHz)

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
36	5180	10.93	10.28	23.054	13.63	16.90	PASS
40	5200	10.97	10.09	22.712	13.56	16.90	PASS
48	5240	10.84	10.28	22.800	13.58	16.90	PASS

***** Gain = 6.1dBi > 6dBi, so the conducted power limit shall be reduced to 17-(6.1-6) = 16.90dBm.

NOTE:

CHAIN 0:

1. 4dBm + 10log(25.33) = 18.04 dBm > 16.90dBm
2. 4dBm + 10log(25.75) = 18.11 dBm > 16.90dBm
3. 4dBm + 10log(25.28) = 18.03 dBm > 16.90dBm

CHAIN 1:

1. 4dBm + 10log(25.13) = 18.00 dBm > 16.90dBm
2. 4dBm + 10log(24.57) = 17.90 dBm > 16.90dBm
3. 4dBm + 10log(25.34) = 18.04 dBm > 16.90dBm

802.11n (40MHz)

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
38	5190	12.08	11.56	30.466	14.84	16.90	PASS
46	5230	13.94	13.77	48.597	16.87	16.90	PASS

***** Gain = 6.1dBi > 6dBi, so the conducted power limit shall be reduced to 17-(6.1-6) = 16.90dBm.

NOTE:

CHAIN 0:

1. 4dBm + 10log(52.65) = 21.21 dBm > 16.90dBm
2. 4dBm + 10log(52.59) = 21.21 dBm > 16.90dBm

CHAIN 1:

1. 4dBm + 10log(51.31) = 21.10 dBm > 16.90dBm
2. 4dBm + 10log(51.31) = 21.10 dBm > 16.90dBm

26dB BANDWIDTH:

802.11a

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)		PASS / FAIL
		CHAIN 0	CHAIN 1	
36	5180	23.55	23.87	PASS
40	5200	24.63	23.14	PASS
48	5240	24.40	23.67	PASS

802.11n (20MHz)

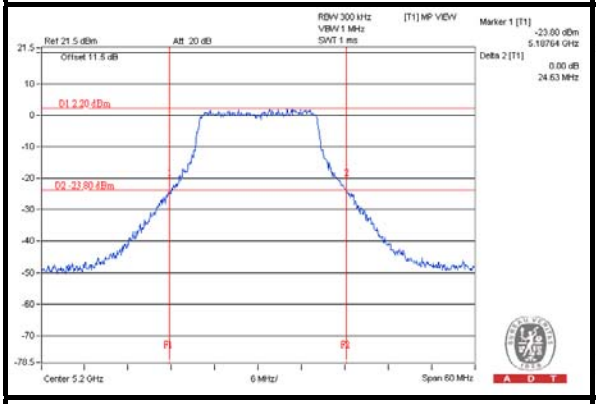
CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)		PASS / FAIL
		CHAIN 0	CHAIN 1	
36	5180	25.33	25.13	PASS
40	5200	25.75	24.57	PASS
48	5240	25.28	25.34	PASS

802.11n (40MHz)

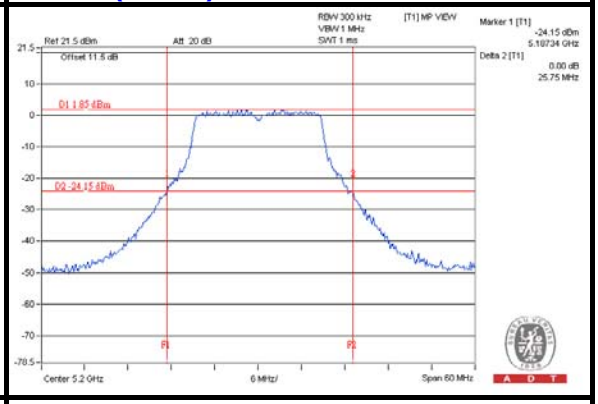
CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)		PASS / FAIL
		CHAIN 0	CHAIN 1	
38	5190	52.65	51.31	PASS
46	5230	52.59	51.31	PASS

SPECTRUM PLOT OF WORST VALUE

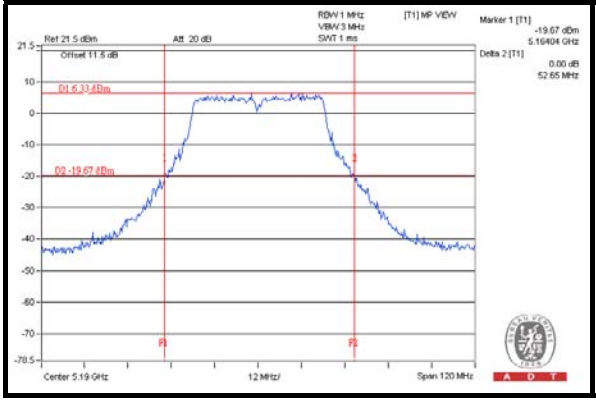
802.11a



802.11n (20MHz)



802.11n (40MHz)



EUT MAXIMUM CONDUCTED POWER

802.11a

FREQUENCY BAND (MHz)	MAX. POWER	
	OUTPUT POWER (mW)	OUTPUT POWER (dBm)
5250~5350	24.051	13.81

NOTE: Manufacturer provides Transmit Power Control description to meet this requirement.

802.11n (20MHz)

FREQUENCY BAND (MHz)	MAX. POWER	
	OUTPUT POWER (mW)	OUTPUT POWER (dBm)
5250~5350	23.054	13.63

NOTE: Manufacturer provides Transmit Power Control description to meet this requirement.

802.11n (40MHz)

FREQUENCY BAND (MHz)	MAX. POWER	
	OUTPUT POWER (mW)	OUTPUT POWER (dBm)
5250~5350	48.597	16.87

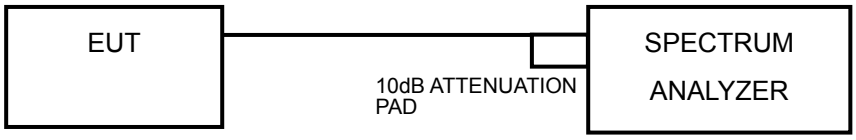
NOTE: Manufacturer provides Transmit Power Control description to meet this requirement.

4.4 PEAK POWER SPECTRAL DENSITY MEASUREMENT

4.4.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT

FREQUENCY BAND	LIMIT
5.15 ~ 5.25GHz	4dBm

4.4.2 TEST SETUP



4.4.3 TEST INSTRUMENTS

Refer to section 4.1.3 to get information of above instrument.

4.4.4 TEST PROCEDURES

Using method SA-2

1) Set span to encompass the entire emission bandwidth (EBW) of the signal.
2) Set RBW = 30 KHz, Set VBW ≥ 1 MHz, Detector = RMS
3) Set Channel power measure = 1MHz
4) Sweep time = auto, trigger set to “free run”.
5) Trace average at least 100 traces in power averaging mode.
6) Record the max value and add 10 log (1/duty cycle)

4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

4.4.6 EUT OPERATING CONDITIONS

Same as 4.3.6.

4.4.7 TEST RESULTS

802.11a

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)		TOTAL PSD W/O DUTY FACTOR (dBm)	DUTY FACTOR	TOTAL PSD WITH DUTY FACTOR (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1					
36	5180	-1.78	-2.77	0.76	0.11	0.87	1.33	PASS
40	5200	-1.88	-2.64	0.77	0.11	0.88	1.33	PASS
48	5240	-1.94	-2.58	0.76	0.11	0.87	1.33	PASS

NOTE: 1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2$] = 8.67dBi > 6dBi, so the power density limit shall be reduced to 4-(8.67-6) = 1.33dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (20MHz)

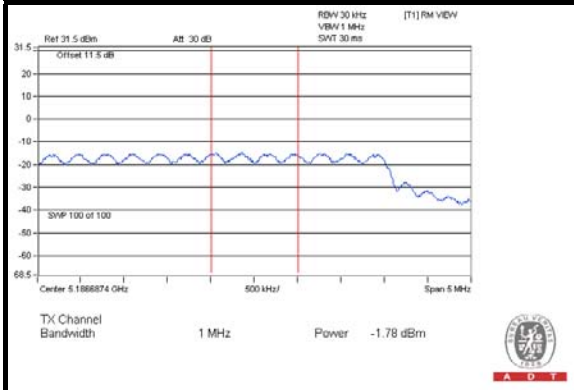
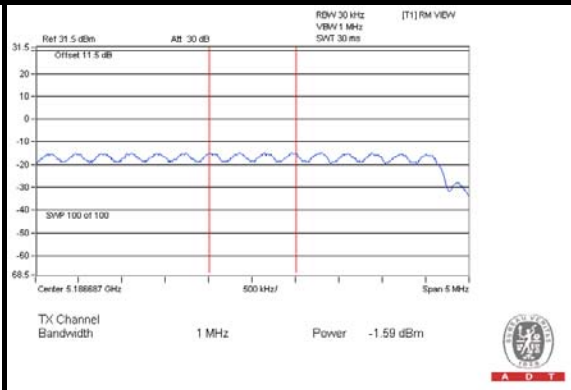
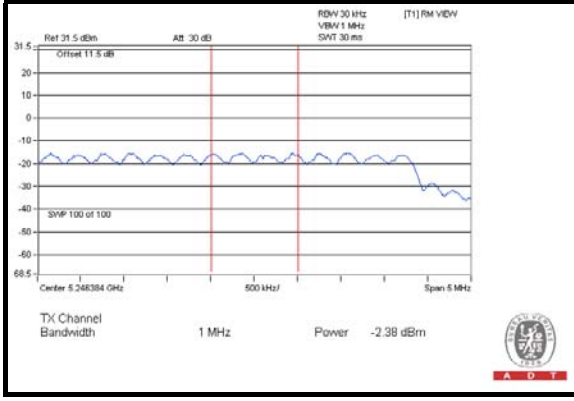
CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)		TOTAL PSD W/O DUTY FACTOR (dBm)	DUTY FACTOR	TOTAL PSD WITH DUTY FACTOR (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1					
36	5180	-1.59	-3.00	0.77	0.11	0.88	1.33	PASS
40	5200	-1.86	-2.88	0.67	0.11	0.78	1.33	PASS
48	5240	-1.81	-2.85	0.71	0.11	0.82	1.33	PASS

NOTE: 1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2$] = 8.67dBi > 6dBi, so the power density limit shall be reduced to 4-(8.67-6) = 1.33dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (40MHz)

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)		TOTAL PSD W/O DUTY FACTOR (dBm)	DUTY FACTOR	TOTAL PSD WITH DUTY FACTOR (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1					
38	5190	-4.60	-5.68	-2.10	0.20	-1.90	1.33	PASS
46	5230	-2.38	-3.02	0.32	0.20	0.52	1.33	PASS

NOTE: 1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + ... + 10^{GN/20})^2$] = 8.67dBi > 6dBi, so the power density limit shall be reduced to 4-(8.67-6) = 1.33dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

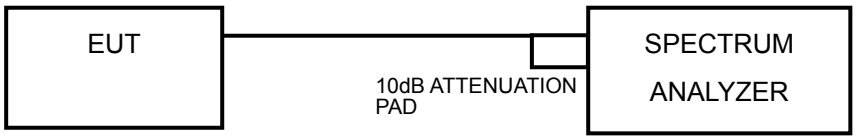
SPECTRUM PLOT OF WORST VALUE	
802.11a	**802.11n (20MHz)**
	
802.11n (40MHz)	
	

4.5 PEAK POWER EXCURSION MEASUREMENT

4.5.1 LIMITS OF PEAK POWER EXCURSION MEASUREMENT

Shall not exceed 13 dB

4.5.2 TEST SETUP



4.5.3 TEST INSTRUMENTS

Refer to section 4.1.3 to get information of above instrument.

4.5.4 TEST PROCEDURE

1) Set RBW = 1 MHz, VBW ≥ 3 MHz, Detector = peak.
2) Trace mode = max-hold. Allow the sweeps to continue until the trace stabilizes.
3) Use the peak search function to find the peak of the spectrum.
4) Measure the PPSD.
5) Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD.

Find the worst channel and modulation mode as above test procedure, and follow KDB 789033 D01 General UNII Test Procedures v01r03 and repeat step 1 to 5 for final testing of each modulation mode on a single channel (all modulation types) in a single operating band to compliance with the peak excursion requirement.

4.5.5 DEVIATION FROM TEST STANDARD

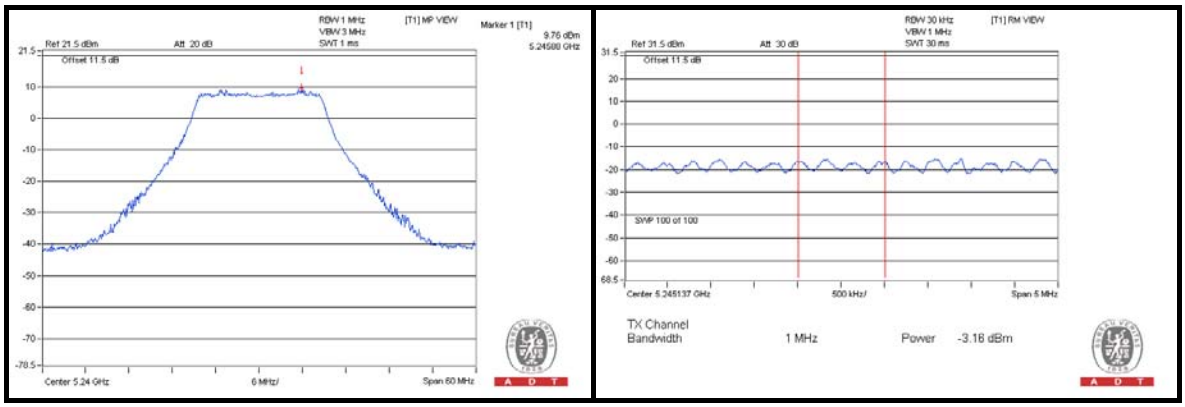
No deviation.

4.5.6 EUT OPERATING CONDITIONS

Same as 4.2.6

4.5.7 TEST RESULTS

MODULATION MODE	MODULATION TYPE	CHAN. FREQ. (MHz)	PEAK VALUE (dBm)	PPSD WITHOUT DUTY FACTOR (dBm)	PPSD WITH DUTY FACTOR (dBm)	PEAK EXCURSION (dB)	LIMIT (dB)	PASS /FAIL
802.11a	BPSK	5240	8.94	-1.94	-1.83	10.77	13	PASS
	QPSK		9.12	-2.09	-1.86	10.98	13	PASS
	16QAM		8.95	-2.05	-1.64	10.59	13	PASS
	64QAM		9.07	-2.74	-1.92	10.99	13	PASS
802.11n (20MHz)	BPSK	5240	8.62	-1.81	-1.69	10.31	13	PASS
	QPSK		9.18	-2.23	-1.99	11.17	13	PASS
	16QAM		8.73	-2.52	-2.09	10.82	13	PASS
	64QAM		9.76	-3.16	-2.34	12.10	13	PASS
802.11n (40MHz)	BPSK	5190	8.89	-2.38	-2.18	11.07	13	PASS
	QPSK		8.44	-2.26	-1.95	10.39	13	PASS
	16QAM		9.01	-2.48	-1.84	10.85	13	PASS
	64QAM		8.71	-3.16	-2.00	10.71	13	PASS

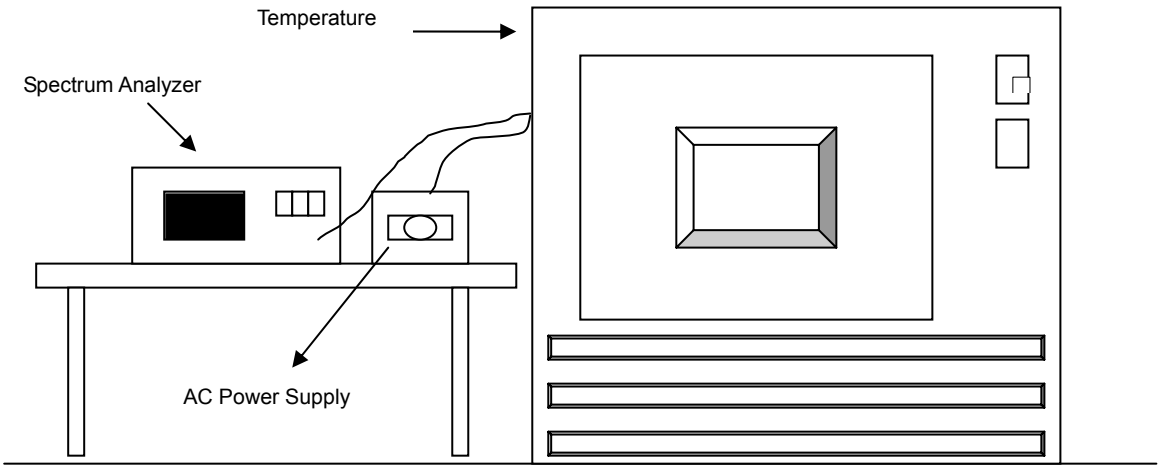


4.6 FREQUENCY STABILITY

4.6.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency of the carrier signal shall be maintained within band of operation

4.6.2 TEST SETUP



4.6.3 TEST INSTRUMENTS

Refer to section 4.1.3 to get information of above instrument.

4.6.4 TEST PROCEDURE

a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.

b. Turn the EUT on and couple its output to a spectrum analyzer.

c. Turn the EUT off and set the chamber to the highest temperature specified.

d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.

e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.

f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

4.6.6 EUT OPERATING CONDITION

Set the EUT transmit at un-modulation mode to test frequency stability.

4.6.7 TEST RESULTS

FREQUEMCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5240MHz									
TEMP. (℃)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
55	120	5239.9772	-0.00044	5239.9771	-0.00044	5239.9743	-0.00049	5239.9822	-0.00034
50	120	5240.0125	0.00024	5240.0062	0.00012	5240.0070	0.00013	5240.0104	0.00020
40	120	5239.9752	-0.00047	5239.9804	-0.00037	5239.9792	-0.00040	5239.9829	-0.00033
30	120	5239.9977	-0.00004	5239.9964	-0.00007	5239.9987	-0.00002	5240.0041	0.00008
20	120	5240.0284	0.00054	5240.0228	0.00044	5240.0231	0.00044	5240.0255	0.00049
10	120	5240.0172	0.00033	5240.0223	0.00043	5240.0204	0.00039	5240.0174	0.00033
0	120	5239.9860	-0.00027	5239.9759	-0.00046	5239.9851	-0.00028	5239.9793	-0.00040
-10	120	5240.0007	0.00001	5240.0025	0.00005	5239.9988	-0.00002	5240.0011	0.00002
-20	120	5240.0066	0.00013	5240.0136	0.00026	5240.0059	0.00011	5240.0106	0.00020
-30	120	5239.9772	-0.00044	5239.9771	-0.00044	5239.9743	-0.00049	5239.9822	-0.00034

FREQUEMCY STABILITY VERSUS VOLTAGE									
OPERATING FREQUENCY: 5200MHz									
TEMP. (℃)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
20	138	5239.9974	-0.00005	5239.9962	-0.00007	5239.9997	-0.00001	5240.0040	0.00008
	120	5239.9977	-0.00004	5239.9964	-0.00007	5239.9987	-0.00002	5240.0041	0.00008
	102	5239.9970	-0.00006	5239.9963	-0.00007	5239.9989	-0.00002	5240.0041	0.00008

5. PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).

6. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.adt.com.tw

The address and road map of all our labs can be found in our web site also.

7. APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

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